

REMARKS

Applicants are amending their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants are incorporating the subject matter of claim 11 into claim 1 (that is, to recite that each of the Rs represents hydrogen). In light of amendments to claim 1, claims 3 and 11 have been cancelled without prejudice or disclaimer. In addition, each of claims 12 and 13 has been amended to recite that the compound represented by the general formula (II) "is included in the photosensitive polymer composition" in a specified amount. Moreover, claim 14 has been amended to recite an alkaline aqueous solution, rather than an alkali aqueous developing solution.

Initially, it is respectfully requested that the present amendments be entered. Noting, in particular, the objection to claims 12 and 13 in Item 2, and rejections of claims in items 3, 6 and 8, on pages 2-6 of the Office Action mailed April 14, 2009, it is respectfully submitted that the present amendments materially limit issues remaining in connection with the above-identified application. Moreover, emphasizing that claim 1 has been amended so as to clearly overcome the rejection under 35 USC 102, by incorporating subject matter of claim 11 into claim 1, and also noting that various of the other amendments have been made in light of suggestions by the Examiner on pages 2-6 of the Office Action mailed April 14, 2009, it is respectfully submitted that the present amendments do not raise any new issues, including any issue of new matter. Noting various additional grounds of rejection in the Office Action mailed April 14, 2009, as well as indication for the first time that the subject matter of claim 11 is not rejected under 35 USC 102, as well as additional arguments made by the Examiner in the Office Action mailed April 14, 2009, it is respectfully submitted that the present amendments are clearly timely.

In view of the foregoing, it is respectfully submitted that Applicants have made the necessary showing under 37 CFR 1.116, such that present entry of the amendments herein is proper notwithstanding Finality of the Office Action mailed April 14, 2009.

Moreover, the undersigned notes the Proposed Declaration submitted concurrently herewith. It is respectfully submitted that entry of this Proposed Declaration (proposed since entry is not a matter of right) is appropriate notwithstanding Finality of the Office Action mailed April 14, 2009, in light of present amendments to claim 1 clearly overcoming the rejection under 35 USC 102, such that the Proposed Declaration becomes relevant in connection with the remaining obviousness rejection under 35 USC 103 of all claims. Clearly, this Proposed Declaration is timely, in light of indication that the subject matter of claim 11 is not rejectable under 35 USC 102, set forth for the first time in the outstanding Office Action mailed April 14, 2009.

The objections to claims 12 and 13 as set forth in Item 2 on page 2 of the Office Action mailed April 14, 2009, is noted. Claims 12 and 13 have been amended to recite that said compound represented by the general formula (II) is included in the "photosensitive polymer" composition "in an amount of" specified parts by weight. Note that, in connection with the objection to claims 12 and 13, the Examiner refers to "an" amount of said compound. In light of present amendments to claims 12 and 13 to recite "an" amount, it is respectfully submitted that the objection to claims 12 and 13 is moot.

Furthermore, in light of amendment of claims 12 and 13 to recite the "photosensitive polymer" composition, it is respectfully submitted that the rejection of claims 12 and 13 under the second paragraph of 35 USC 112, set forth in Item 6 on

page 3 of the Office Action mailed April 14, 2009, is moot. In connection with this rejection under the second paragraph of 35 USC 112, the comment by the Examiner that perhaps Applicants meant “the photosensitive polymer composition”, is noted. As correctly appreciated by the Examiner, Applicants did mean the photosensitive polymer composition in claims 12 and 13, claims 12 and 13 being amended to recite the photosensitive polymer composition.

Rejection of claim 14 under the first paragraph of 35 USC 112, set forth in Item 4 on pages 2 and 3 of the Office Action mailed April 14, 2009, is noted. Applicants have amended claim 14 to recite “an alkaline aqueous solution”, consistent with the description in paragraph [0063] on page 18 of Applicants’ Substitute Specification submitted with the Preliminary Amendment filed July 12, 2006 (hereinafter “Applicants’ Substitute Specification”). In this regard, note the indication by the Examiner that on page 18 of Applicants’ Substitute Specification, there is a description that the developing solution may be an “alkaline aqueous solution”. Noting especially this indication by the Examiner, and present amendment of claim 14 to recite “an alkaline aqueous solution”, in view of present amendments to claim 14 it is respectfully submitted that the rejection under the first paragraph of 35 USC 112 is moot.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed April 14, 2009, that is, the teachings of U.S. Patent Application Publication No. 2003/0204117 to Matsuishi, et al., and Japanese Patent Document No. 2001-312063 (designed by the Examiner as “Tadayuki, et al.”), under the provisions of 35 USC 102 and 35 USC 103.

Initially, it is again noted that Applicants have incorporated the subject matter of claim 11 into claim 1; and that claim 11 was not rejected under 35 USC 102 in Item 8 on page 4 of the Office Action mailed April 14, 2009. Accordingly, it is respectfully submitted that the rejection of claims under 35 USC 102(b), as being anticipated by Tadayuki, et al., is moot.

In any event, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a photosensitive polymer composition as in the present claims, including, in addition to the recited polyamide and the compound which generates an acid upon receiving light, the compound represented by the general formula (II) in claim 1, including wherein each of the Rs of this compound represents hydrogen. See claim 1.

As will be shown in the following, in Tadayuki, et al., the substituent R in the component (c) is an alkyl group or an alkenyl group. In contrast, according to the present invention the substituent "R" in the component (c) is hydrogen, clearly different from the substituent "R" in Tadayuki, et al.

Moreover, as will be discussed further infra, the presently claimed subject matter, with the compound represented by the general formula (II) including each of the Rs representing hydrogen, achieves unexpectedly better results as compared to corresponding compositions in Tadayuki, et al. including components (a) and (b) as in the present claims, but with a different compound than that of compound (c) of the present claims. Emphasizing that the comparison in the enclosed Proposed Declaration Under 37 CFR 1.132 of M. Ooe is a comparison with the most desirable corresponding compound as disclosed in Tadayuki, et al., it is respectfully submitted that Tadayuki, et al., either alone or in combination with the teachings of Matsuishi, et al., would have neither taught nor would have suggested the presently claimed

invention, including wherein the photosensitive polymer composition includes the compound (c) represented by the general formula (II), with each of the Rs thereof representing hydrogen, and unexpectedly better results achieved thereby.

Moreover, it is respectfully submitted that the teachings of the applied references, particularly of Tadayuki, et al., describing many different materials for the component (c), would not have led one of ordinary skill in the art to the specific photosensitive polymer composition of the present claims, including the compound represented by the general formula (II); and, in any event, the teachings of the applied references would have neither disclosed nor would have suggested unexpectedly better results achieved by the presently claimed composition, including the component (c), particularly with respect to sensitivity of the composition, as discussed infra.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a method of producing a pattern, including applying the photosensitive polymer composition according to claim 1 on a support substrate, with subsequent light exposure, development and heat treatment (see claim 8); or the electronic part including an electronic device having a layer of a pattern obtained by the method according to claim 8 (see claim 10).

In addition, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such a photosensitive polymer composition as in the present claims, having features as discussed previously in connection with claim 1, and, additionally, amounts of components in the composition as in claims 4, 12 and 13.

Moreover, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such method of producing a pattern as in the present claims, having features as discussed previously in connection with claim 8, and, additionally, wherein the exposure light source used in the step of exposure generates i-line (see claim 9); and/or wherein the developing is performed utilizing an alkaline aqueous solution (see claim 14); and/or wherein the heat treating is performed at a temperature in a range of 150°-450°C (see claim 15).

In addition, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such photosensitive polymer composition as in the present claims, having features as discussed previously in connection with claim 1, and, additionally, wherein the composition further includes a compound (component (d)) which reduces solubility of the component (a) with respect to an alkali aqueous solution (note claim 5); in particular, wherein this compound which reduces solubility of the component (a) is a diaryliodonium salt represented by the general formula (III) in claim 6, or wherein amounts of components (b)-(d) are those set forth in claim 7.

The present invention relates to a photosensitive polymer composition, a method of producing a pattern using such composition, and electronic parts formed by such method using this composition. In the electronic part, the pattern formed of the composition remains as a component of the electronic part. The composition becomes a polybenzoxazole heat resistant polymer by heat treatment, and can be used, to be illustrative and not to be limiting, as a surface protection film and/or an interlayer insulating film in electronic parts such as semiconductor devices.

Conventionally, polyimide has been widely used as a surface protection or interlayer insulating film, due to advantages in resistance to heat, and advantages in mechanical properties and electrical properties, as well as easy film formability and ability to be planarized. Photosensitive polyimide compositions have use, e.g., in order to avoid the need of a photoresist. In addition, as described in paragraph [0007] on pages 2 and 3 of Applicants' Substitute Specification, positive type photosensitive polyimides have been proposed.

However, such previously proposed polyimide compositions have low sensitivity, because they are sensitive to wavelengths mainly of 300nm or less. In particular, it is difficult to use such compositions with i-line steppers, which have a single wavelength of light at 365nm, recently used in, e.g., manufacture of electronic parts.

While it has been proposed to add a phenol binuclear compound for enhancing sensitivity of compositions including a polyimide precursor, when the phenol binuclear compound is added the pattern is easily deformed by melting of the phenol compound in a thermal cure process after development, resulting in a problem such as degradation of resolution. Thus, it has been difficult to provide a photosensitive polymer composition having sufficient sensitivity, yet which does not cause pattern deformation in the thermal cure process after development.

Against this background, Applicants provide a photosensitive polymer composition having both high sensitivity and which gives a pattern that retains its form in a step of thermal curing; that is, which provides a pattern having a high resolution and good shape, yet wherein the composition has high sensitivity. Applicants have found that by incorporating the component (c) in the composition which includes the recited polyamide component (a) and the compound (b) which

generates an acid upon receiving light, the component (c) increases a dissolving speed of the exposed portion to enhance the sensitivity when developed in the alkali aqueous developing solution. Note paragraph [0042] on page 14 of Applicants' Substitute Specification. See also paragraphs [0014]-[0016] on page 7 of Applicants' Substitute Specification.

Attention is respectfully directed to the enclosed Proposed Declaration executed by M. Ooe. This Proposed Declaration reports, in declaration form, the results of Additional Comparative Examples A and B, using materials within the scope of the ingredient (c) of Tadayuki, et al., but outside the scope of compound (c) of the present claims with each of the Rs representing hydrogen. Note that Additional Comparative Example A of the Proposed Declaration includes bis(2-hydroxy-3-methoxymethyl-5-methylphenyl)methane, described as having "the high most desirable effect" for the composition of Tadayuki, et al., in paragraph [0041] of Tadayuki, et al. As described in Item 7 on the fifth page of the enclosed Proposed Declaration, and from the results set forth in Item 6 bridging the fourth and fifth pages thereof, it has been shown that photosensitive polymer compositions as in the present claims, including compound (c), have unexpectedly higher sensitivity than corresponding photosensitive polymer compositions as in Tadayuki, et al., having compounds (a) and (b) as in the present compositions, but with an ingredient (c) outside the scope thereof.

Thus, and as is clearly supported by the enclosed Proposed Declaration, Applicants have selected a group of compounds for compound (c) which, together with compounds (a) and (b), provides unexpectedly better results in sensitivity, as compared with the teachings of Tadayuki, et al. Again emphasizing that Tadayuki, et al. selects other materials having the "most desirable effect" for ingredient (c), it is

respectfully submitted that the teachings of Tadayuki, et al., even together with the teachings of Matsuishi, et al., would have neither disclosed nor would have suggested the presently claimed subject matter, and advantages achieved thereby.

Tadayuki, et al. discloses a positive type photosensitive polymer composition that contains (a) a polyamide having repeating units of a formula (I) as on page 2 of this patent document; (b) a compound which generates an acid under light; and (c) a compound having alkoxymethyl and phenolic hydroxyl groups in one molecule. Note, for example, paragraphs [0008]-[0010] of the machine-generated English translation of Tadayuki, et al. See also paragraphs [0037] and [0038] of this patent document, further describing this compound which has two or more alkoxymethyl groups and phenolic hydroxyl groups. Note also the Example of Tadayuki, et al., beginning in paragraph [0059] thereof. As to the compounds for ingredient (c) in Tadayuki, et al., listed in paragraphs [0040] and [0041] in Tadayuki, et al., bis(2-hydroxy-3-methoxymethyl-5-methylphenyl)methane is mentioned as having the highest most desirable effect.

Noting especially the specific material described as the most desirable effect in Tadayuki, et al., it is respectfully submitted that the teaching of this reference do not disclose, nor would have suggested, such composition as in the present claims, including the component (c) thereof, and in particular advantages achieved by the photosensitive resin composition of the present claims, including the component (c).

It is respectfully submitted that the additional teachings of Matsuishi, et al. would not have rectified the deficiencies of Tadayuki, et al., such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Matsuishi, et al. discloses hydroxymethyl-substituted polyfunctional phenols, wherein one phenol nucleus contains two hydroxymethyl groups as nucleus substitution groups. Note especially paragraphs [0008]-[0019] on page 1 of this patent document. This patent document goes on to describe, in paragraph [0044] on page 4 thereof, that compounds described therein can be used as photoresist material or to derive polyphenol compounds through further reaction with phenolic compounds; and that the compounds are also usable as compounding agents that add to the molecular weight of novolac phenol resins or as hardening agents for epoxy resins used in casting and powder coating.

Initially, it is noted that Tadayuki, et al., is concerned with photosensitive polymer compositions and methods for forming patterns, remaining in the formed device, using such compositions; while Matsuishi, et al., is concerned with specific compounds that can be used as photoresist materials or to derive polyphenol compounds through further reaction with phenolic compounds, among other uses. Tadayuki, et al. is directed to providing a photosensitive polymer composition having high sensitivity, among other properties, while Matsuishi, et al. is concerned with providing, among other materials, photoresist materials providing chemical reactions with phenols. In view of different technologies involved with in these two references, as well as different problems addressed by each, it is respectfully submitted that one of ordinary skill in the art concerned with in Tadayuki, et al. would not have looked to the teachings of Matsuishi, et al. In other word, it is respectfully submitted that these references are directed to non-analogous arts.

Furthermore, different problems addressed by Tadayuki, et al. and by Matsuishi, et al., discussed previously, are again noted. Particularly in view thereof,

it is respectfully submitted that the Examiner has pointed to no proper reason for combining the teachings of these references.

In addition, it is respectfully submitted that Tadayuki, et al. discloses that by providing an alkyl group or an alkenyl group for the substituent "R" in the general formula (II) of ingredient (c), it is possible to increase a dissolving speed of the exposed portion, to enhance sensitivity when developing by using an aqueous solution, while preventing dissolution of the film when curing the film after the pattern has been formed. Note paragraph [0037] in Tadayuki, et al. Accordingly, it is respectfully submitted that replacement of the substituent "R" in ingredient (c) of Tadayuki, et al. would destroy the teachings of Tadayuki, et al., for its intended purpose. For this reason also, the combination of Tadayuki, et al. and Matsuishi, et al., as applied by the Examiner, destroying Tadayuki, et al. for its intended purpose, is improper.

In contrast, in Matsuishi, et al., it is important to have a hydroxy methyl group in the general structure (I), as seen in paragraph [0009] on page 1 of this reference. For example, as described in paragraph [0044] on page 4 of Matsuishi, et al., desired effects are manifested after reaction with hydroxymethyl groups. It is respectfully submitted that while the effect of Tadayuki, et al. is caused by using alkoxymethyl groups, the effect of Matsuishi, et al. is caused by using hydroxymethyl groups. Since the effects in groups are different from each other, it is respectfully submitted that it would not have been obvious to substitute the hydroxymethyl group of Matsuishi, et al. for the alkoxymethyl group of Tadayuki, et al.

Furthermore, even assuming, arguendo, that the teachings of Tadayuki, et al. and of Matsuishi, et al. were properly combinable, the unexpectedly better results achieved according to the present invention, in improved sensitivity, is noted. Such

result is especially unexpected in light of the teachings in Tadayuki, et al. of bis(2-hydroxy-3-methoxymethyl-5-methylphenyl)methane having the most desirable effect. It is respectfully submitted that the unexpectedly better results achieved by the present invention overcomes any possible prima facie case of obviousness established by the teachings of the applied references, i.e., Tadayuki, et al. and Matsuishi, et al., and establish unobviousness of the presently claimed subject matter.

Contentions by the Examiner on page 4 of the Office Action mailed April 14, 2009, in connection with the teachings of Tadayuki, et al., including reference by the Examiner that the substituent "X" in Tadayuki, et al. may be a propylene group or of the type of an ethylidene group, and all of the substituents on the group may be fluorine atoms, the Examiner referring to paragraph [0038] of Tadayuki, et al., is noted. However, it is respectfully submitted that Tadayuki, et al. discloses many different compounds which can be used for ingredient (c) having the general formula (II). Again, it is emphasized that Tadayuki, et al. describes as the highest "most desirable effect" is the compound set forth in paragraph [0041] of this patent document, outside the scope of compound (c) of the present claims. Especially in view of the unexpectedly better results in sensitivity achieved through use of the compound (c) of the present claims together with the polyamide (a) and compound (b) according to the present claims, it is respectfully submitted that any possible prima facie case of obviousness has been overcome.

The contention by the Examiner in the second full paragraph on page 9 of the Office Action mailed April 14, 2009, is noted. It is respectfully submitted that Applicants, in the enclosed evidence, compare the most desirable compound for ingredient (c) in Tadayuki, et al., showing unexpectedly better results in sensitivity as

compared thereto. As can be appreciated, and again emphasizing that Tadayuki, et al. discloses that the compound in paragraph [0041] has the most desirable effect, other compounds in Tadayuki, et al. would have a lesser effect. It is respectfully submitted that the enclosed Proposed Declaration, providing a comparison with respect to the compound set forth in paragraph [0041] in Tadayuki, et al., establishes unexpectedly better results with respect to the best closest prior art as described in the primary reference, for overcoming any possible prima facie case of obviousness established by the teachings of the applied references.

Comments by the Examiner in the paragraph bridging pages 9 and 10 of the Office Action mailed April 14, 2009, are noted. Note that the Examiner does not traverse prior contentions by Applicants that Matsuishi, et al. is directed to a different field of endeavor, and addresses different problems. Moreover, note that the present invention addresses the issue of increased sensitivity. It is respectfully submitted that the Examiner has not established that one of ordinary skill in the art concerned with in connection with the present invention, would have looked to the teachings of Matsuishi, et al. with respect to problems addressed thereby.

The contention by the Examiner that the results of a substitution of hydrogen for the Rs of ingredient (c) of Tadayuki, et al., as being predictable to one having ordinary skill, is respectfully traversed, particularly in view of the evidence or record in the enclosed Proposed Declaration, showing unexpectedly better results achieved as compared with the ingredient (c) having the most desirable effect in Tadayuki, et al.

That is, it is respectfully submitted that unexpectedly better sensitivity would not have been predictable to one having ordinary skill in the art in view of the teachings of Tadayuki, et al. and of Matsuishi, et al.

July 14, 2009

In view of the foregoing comments and amendments, and further in view of the enclosed Proposed Declaration, entry of the present amendments and of the enclosed Proposed Declaration, and reconsideration and allowance of all claims in the above-identified application, are respectfully requested.

Applicants request any shortage in fees due in connection with the filing of this paper be charged to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (case 1270.46327X00), and credit any excess payment of fees to such Deposit Account.

Respectfully submitted,

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Enclosure: Proposed Declaration (M. Ooe, 5 pp.)

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